

4-quadrant magnet power supply

CANCUN [±20 A; ±75 V] – HCRPAAO
CANCUN [±50 A; ±30 V] – HCRPAAN
CANCUN [±100 A; ±30 V] – HCRPAEH

CANCUN is a family of 1.5kW isolated switched mode power supplies working in four-quadrant operation mode. It can provide positive or negative current to the magnet with cycling operation and recovering magnet energy. CANCUN is designed to fit in a 19-inch rack with a height of 4U. Up to eight CANCUN can be mounted in a 19-inch rack, including control distribution (figure 2). CANCUN includes an FGC3 control boards, to ensure a high precision current control with two DCCTs, in the range of 20 ppm of accuracy.



Principle Schematics

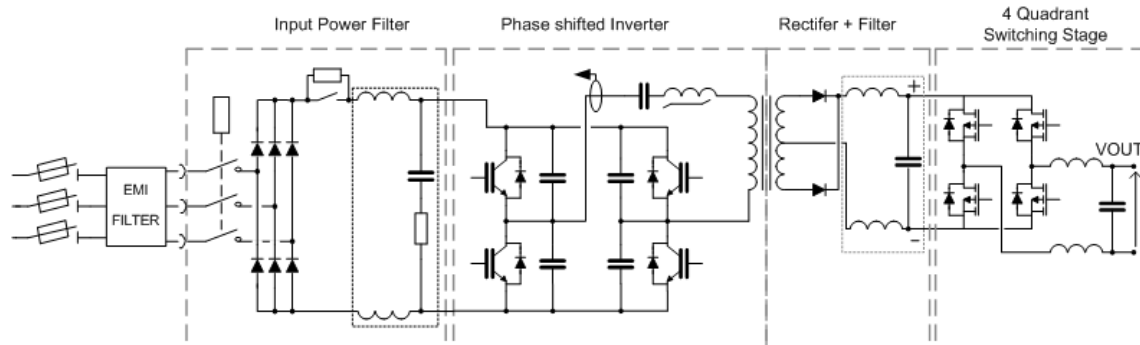


Figure 1: Schematic

Power Ratings

Rating	CANCUN 20, CANCUN 50, CANCUN 100	Value	Unit
Number of phase	3P+N+PE AC connection	3	
Input voltage		400	V _{RMS}
Input current		<3	A
Isolation class	Isolation level to ground	3	kVAC
Power factor		>0.9	
Efficiency		>75%	
Switching frequency		50	kHz

Table 1: CANCUN family common power ratings

Rating	CANCUN 20	Value	Unit
Output current	cycling or DC operation	±20	A
Output voltage	cycling or DC operation	±75	V
Load resistance		0.0001...3.75	Ω
Load inductance		0...1000	mH

Table 2: CANCUN 20 Ratings

Rating	CANCUN 50	Value	Unit
Output current	cycling or DC operation	±50	A
Output voltage	cycling or DC operation	±30	V
Load resistance		0.0001...0.6	Ω
Load inductance		0...1000	mH

Table 3: CANCUN 50 Ratings

Rating	CANCUN 100	Value	Unit
Output current	cycling	±100	A
	DC operation	±50	A
Output voltage	cycling or DC operation	±30	V
Load resistance		0.0001...0.3	Ω
Load inductance		0...1000	mH

Table 4: CANCUN 50 Ratings

Mechanical Characteristics

Characteristics		
Size	Height x Width x Depth	178 x 482.6 x 650 mm
Weight		29 kg
IP	Electrical enclosure protection	IP21
Cooling		Forced-air cooling

Table 5: Mechanical Characteristics

CANCUN Current Control

CANCUN includes a FGC3 control board in the front panel. CANCUN can be controlled locally with a computer through FGC3 USB interface or more generally through a front-end computer connected by FGC ETHER interface (ETHERNET cable).

Parameter		Value	Unit
Output current acquisition frequency		10	kHz
Current reference sampling frequency		10	kHz
Current control algorithm	CClibs included in FGC3 software		
Output Voltage ripple	20 – 1kHz	10	mVrms
	1kHz – 130kHz	60	mVrms
	130kHz – 5MHz	7	mVrms
Current precision performance	Short term stability (20 min)	5	ppm
	stability (12h)	20	ppm
	Long term stability (1 year)	100	ppm
	Noise (500Hz bandwidth)	25	rms ppm
Setting current resolution		1	ppm

Table 3: Current control performance

CANCUN magnet protection

CANCUN includes a magnet protection with three key rules, ensure external protection system to stop the power supply, stop the power supply in a safe way through a crowbar system and monitor earth current. The earth system, placed at the negative output, will stop the power supply if the linkage current is above 50mA.

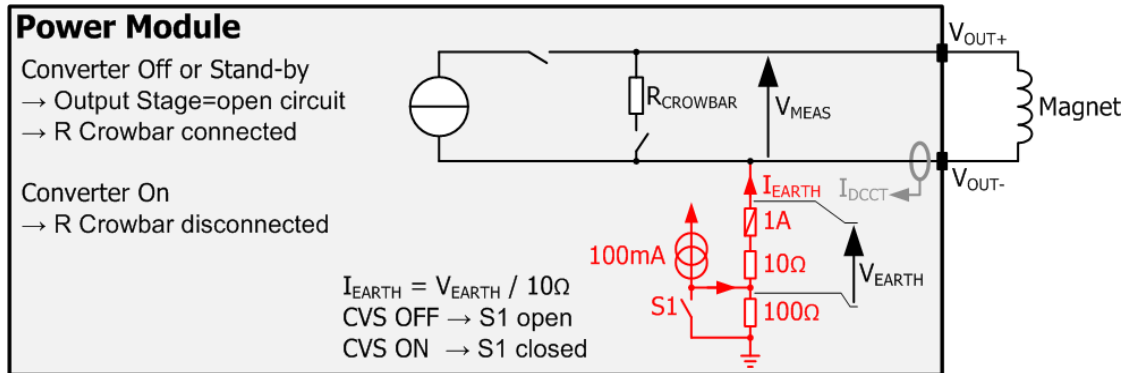


Figure 2: Magnet protection

CANCUN interfaces

External interlocks can stop the power supply through two connectors (Veto Access and Magnet interlock). Hardwire status are available for external systems.

Parameter	Value	Description
VETO ACCESS	Burndy UTO-010-4S-21T	1: veto access+ (input) 2: veto access- (input) 3: power on state+ (output, dry contact) 4: power on state- (output, dry contact)
MAGNET INTLK	Burndy UTO-014-12S-21T	1: Powering failure+ (output, dry contact) 2: Powering failure- (output, dry contact) 5: PC connect+ (output, bridge) 6: PC connect- (output, bridge) 7: PC fast abort+ (input) 8: PC fast abort- (input) 11: PC permit+ (input) 12: PC permit- (input)

Table 4: Rear connector interfaces

CANCUN rack integration

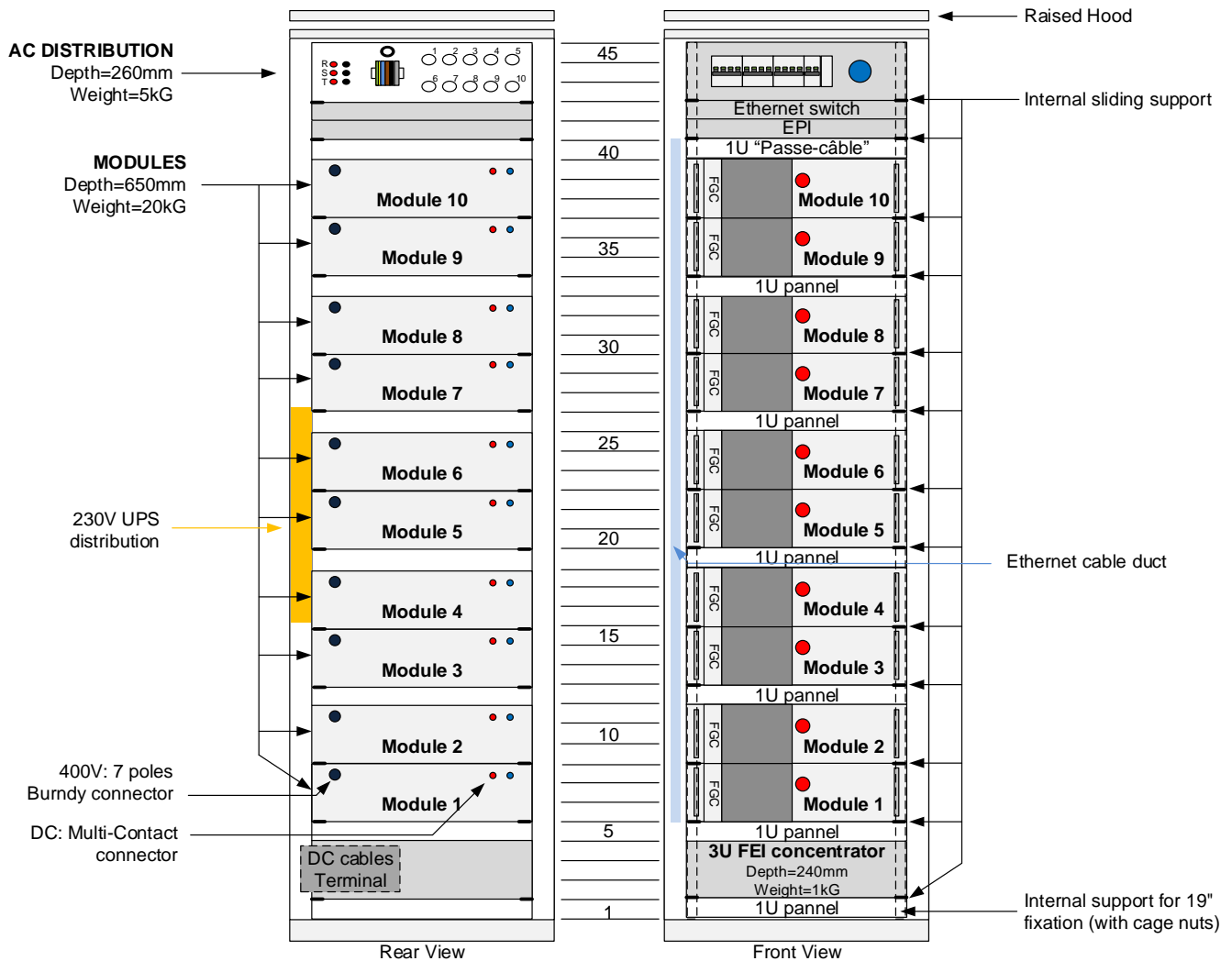


Figure 3: CANCUN rack with 10 units

Example of operating cycle

Example of current cycle played in the Proton Synchrotron machine at CERN with a CUNCUN 20 powering a corrector magnet rated, 2.2Ω , 25mH.



Figure 4: CUNCUN 20, output current in blue, output voltage in orange. X-axis in second, Y-axis in ampere and volt