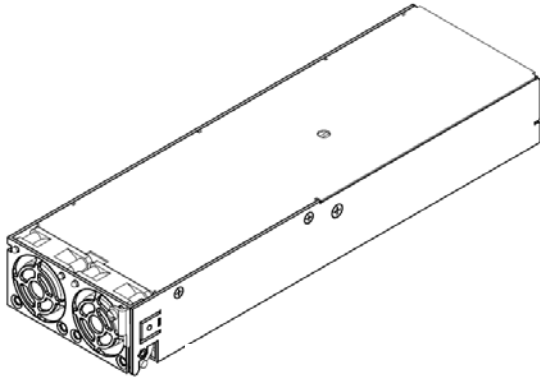


CAR0724FP series front-end

Input: 100-120/200-240V_{AC}; Output: 24V_{DC} @ 750W; 5V_{DC} @ 0.5A



Applications

- Industrial equipment
- Telecommunications equipment
- Test and Measurement Instruments
- ATE Equipment

Features

- Size 284.7 mm x 90.4 mm x 40.9 mm (11.21 in x 3.56 in x 1.61 in)
- Universal AC Input Range (90 – 264VAC)
- No de-rating at low input line
- Stand-by Output of 5V @ 0.5A
- I2C serial bus monitors operating parameters
- 86% Efficiency at 230VAC Full Load
- Remote ON/OFF control
- Active Current Sharing
- Full load: 0°C to 50°C, derated to 70°C
- Output over current protection (non-latching)
- Output over voltage protection
- Input under voltage protection
- Over Temperature protection
- 12ms of holdup time
- Radiated and Conducted EMI - meets CISPR22 (EN55022) **Class A** requirements
- Compliant to RoHS EU Directive 2002/95/EC
- UL and cUL approved to UL/CSA60950-1, TUV (EN60950-1), CE Mark and CB Report available
- ISO** 9001 and ISO 14001 certified manufacturing facilities

Description

The CAR0724FP front end provides efficient isolated power from world-wide commercial AC mains. Offered in the industry standard compact 1U form factor, these front ends provide comprehensive solutions for systems connected to commercial ac mains.

* UL is a registered trademark of Underwriters Laboratories, Inc.

† CSA is a registered trademark of Canadian Standards Association.

‡ VDE is a trademark of Verband Deutscher Elektrotechniker e.V.

§ Intended for integration into end-user equipment. All the required procedures for CE marking of end-user equipment should be followed. (The CE mark is placed on selected products.)

** ISO is a registered trademark of the International Organization of Standards.

+ PMBus name and logo are registered trademarks of the System Management Interface Forum (SMIF)

CAR0724FP series rectifier

Input: 100-120/200-240V_{AC}; Output: 24V_{DC} @ 750W; 5V_{DC} @ 0.5A

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only, functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the Technical Requirement. Exposure to absolute maximum ratings for extended periods can adversely affect the device reliability.

Parameter	Symbol	Min	Max	Unit
Input Voltage: Continuous	V _{IN}	0	264	V _{AC}
Operating Ambient Temperature	T _A	-10	70 ¹	°C
Storage Temperature	T _{stg}	-40	85	°C
I/O Isolation voltage to Frame (100% factory Hi-Pot tested)			1500	V _{AC}

Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, load, and temperature conditions.

INPUT					
Parameter	Symbol	Min	Typ	Max	Unit
Operational Range	V _{IN}	90	110/230	264	V _{DC}
Frequency Range	F _{IN}	47	50/60	63	Hz
Main Output Turn_OFF	V _{IN}	68.4	72	75.6	V _{AC}
Main Output Turn ON	V _{IN}	76	80	84	V _{AC}
Maximum Input Current (V _{OUT} = 24V _{DC} , I _{OUT} =31A)	V _{IN} = 100V _{AC} V _{IN} = 200V _{AC} I _{IN}		9.2 4.6		A _{AC}
Cold Start Inrush Current (Excluding x-caps, 25°C)	peak duration I _{IN}			40 ½	A _{PEAK} cycle
Fuse rating	line & neutral	20A / 250V _{AC} 3AB type			
Efficiency (T _{AMB} =25°C, V _{OUT} = 24V _{DC} , I _{OFL} = 31A)	input η	81.5	86		%
Power Factor (V _{IN} =90 - 264V _{AC} , I _{OUT} = 31A)	PF	0.95	0.99		
Holdup time (V _{IN} = 90V _{AC} , T _{AMB} 25°C, V _{OUT} = 24V _{DC} , I _{OUT} = 31A)	T	10	12		ms
Leakage Current (V _{IN} = 264V _{AC} , F _{IN} = 60Hz)				3.5	mA
Isolation	Input/Frame V _{DC}	2600			V _{DC}
Transient protection	MOV and gas tube based				

¹ Derated above 50°C at 2.5%/°C

CAR0724FP series rectifier

Input: 100-120/200-240V_{AC}; Output: 24V_{DC} @ 750W; 5V_{DC} @ 0.5A

24V _{DC} MAIN OUTPUT						
Parameter	Symbol	Min	Typ	Max	Unit	
Output Power	W	0	-	750	W	
Regulation Set point ($V_{IN} = 220V_{AC}$, $T_{AMB} = 25^{\circ}C$, $I_{OUT} = 15A$) Temperature drift Overall regulation (line, load, temperature) Maximum remote sense voltage drop	V_{OUT}	23.75	24.00	24.25	V_{DC}	
				0.01	%/°C	
		-5		+5	%	
				0.5	V_{DC}	
Turn-ON or turn-OFF overshoot/undershoot		-5		+5	%	
Turn-ON delay to within regulation	T			3	sec	
Remote ON/OFF delay time				40	ms	
Turn-ON monotonic rise time (10 – 90% of V_{OUT})				150	ms	
Transient response 25% step [10%-35%, 100% - 75%] ($di/dt = 1A/\mu s$, recovery to within 1% of nominal in 5ms)	V_{OUT}	-0.5		+0.5	V_{DC}	
Ripple and noise (20MHz bandwidth, measured across 10 μf & 0.1 μf capacitors)	V_{OUT}			240	mV _{p-p}	
Overvoltage protection, latched (recovery by cycling OFF/ON via hardware or software)		28		32	V_{DC}	
Output current	I_{OUT}	0		31.25	A_{DC}	
Current limit, Foldback		35.3		40.1	A_{DC}	
Current share		-10		10	% of FL	

5V _{DC} Standby output						
Parameter	Symbol	Min	Typ	Max	Unit	
Set point	V_{OUT}		5		V_{DC}	
Overall regulation (load, temperature, aging)	V_{OUT}	4.8		5.2	V_{DC}	
Ripple and noise				50	mV _{p-p}	
Output current	I_{OUT}	0		0.5	A_{DC}	

General Specifications

Parameter	Min	Typ	Max	Units	Notes
Reliability		300,000 100,000		hrs	Full load, 25°C per Bellcore RPP Full load, 50°C per Bellcore RPP
Service Life		10		Yrs	Full load, excluding fans
Weight		1.09 (2.4)	1.4(3.1)	Kgs (Lbs)	

CAR0724FP series rectifier

Input: 100-120/200-240V_{AC}; Output: 24V_{DC} @ 750W; 5V_{DC} @ 0.5A

Feature Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature conditions. All signals are referenced to Signal_Return unless otherwise noted. See Feature Descriptions for additional information. (I_{OL} < 20mA, I_{OH} < 20μA)

Parameter	Symbol	Min	Typ	Max	Unit
Remote ON/OFF					
24V output ON	V _I	0.7V _{DD}	—	5	V _{DC}
24V output OFF	V _I	0	—	0.8	V _{DC}
AC_OK (pulled HI via a 10kΩ resistor to 5V standby)					
Logic HI Input within normal range	V _{OH}	0.7V _{DD}	—	5	V _{DC}
Logic LO Input not-within normal range	V _{OL}	0	—	0.4	V _{DC}
DC_OK (pulled HI via a 4.75kΩ resistor to 5V standby)					
Logic HI Output voltage is within limits	V _{OH}	0.7V _{DD}	—	5	V _{DC}
Logic LO Output voltage is outside of limits	V _{OL}	0	—	0.4	V _{DC}
Temp_OK (pulled HI via a 4.75kΩ resistor to 5V standby)					
Logic HI temperature within normal range	V _{OH}	0.7V _{DD}	—	5	V _{DC}
Logic LO temperature outside of normal range	V _{OL}	0	—	0.4	V _{DC}
Delayed shutdown ² after Logic LO transition	T _{delay}		10		sec
Fault (open collector; max applied voltage V _{DD} : 12V _{DC})					
Logic HI normal	V _{OH}	0.7V _{DD}	—	V _{DD}	V _{DC}
Logic LO fault	V _{OL}	0	—	0.4	V _{DC}
I²C address signals A0, A1, A2 (internally pulled HI)					
Logic LO	V _{IL}	0	—	0.1	V _{DC}
I²C Clock and Data Lines (must be pulled up externally to 5V _{DC})					
Logic HI	V _{OH}	0.7V _{DD}	—	5	V _{DC}
Logic LO (Data line sync'd by the power supply)	V _{OL}	0	—	0.4	V _{DC}
Logic LO (interpreted by the power supply)	V _{OL}	0	—	0.8	V _{DC}
Write protect	Factory use only. Pulling LO disables write protect				
Interrupt (open collector; max applied voltage V _{DD} : 5V _{DC})					
Logic HI normal	V _{OH}	0.7V _{DD}	—	V _{DD}	V _{DC}
Logic LO asserted	V _{OL}	0	—	0.4	V _{DC}

Digital Interface Specifications

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
PMBus Signal Interface Characteristics						
Input Logic High Voltage (CLK, DATA)		V _{IH}	2.1		3.6	V _{DC}
Input Logic Low Voltage (CLK, DATA)		V _{IL}	0		0.8	V _{DC}
Input high sourced current (CLK, DATA)		I _{IH}	0		10	μA
Output Low sink Voltage (CLK, DATA)	I _{OUT} =3.5mA	V _{OL}			0.4	V _{DC}
Output Low sink current (CLK, DATA)		I _{OL}	3.5			mA
Output High open drain leakage current (CLK, DATA)	V _{OUT} =3.6V	I _{OH}	0		10	μA
Operating frequency range	Slave Mode	F _{PMB}	10		400	kHz

² Auto restart after the unit cools down into its normal range

CAR0724FP series rectifier

Input: 100-120/200-240V_{AC}; Output: 24V_{DC} @ 750W; 5V_{DC} @ 0.5A

Environmental Specifications

Parameter	Min	Typ	Max	Units	Notes
Ambient Temperature	0		50	°C	
Storage Temperature	-40		85	°C	
Operating Altitude			1524/5000	m/ft	
Non-operating Altitude			15240/50k	m / ft	
Power Derating with Altitude			2.0	°C/301 m °C/1000 ft	
Acoustic noise			55	dbA	25°C and Full load
Humidity Operating Storage	5 5		95 95	%	Relative humidity, non-condensing
Vibration			0.2	G	IEC 68-2-6, 5-500Hz
Shock			10	G	IEC 68-2-27, 10ms intervals 3 shocks per axis

EMC Compliance

Parameter	Criteria	Standard	Level	Test
AC input	Conducted emissions	FCC and CISPR (EN55022A, VCCI-2)	A +6dB	0.15 – 30MHz
Radiated emissions		EN55022	A +6dB	30 – 10000MHz
Harmonic current	Emissions	EN-61000-3-2	Table 1	
Voltage	Fluctuations & Flicker	En-61000-3-3		
AC Input immunity	Voltage dips	EN61000-4-11	A	-30%, 10ms
			B	-60%, 100ms
			B	-100%, 5sec
	Voltage surge	EN61000-4-5	A	2kV, 1.2/50µs, common mode
			A	1kV, 1.2/50µs, differential mode
	Fast transients	EN61000-4-4	B	±0.5kV on data lines, ±1kV on power lines, 5kHz rate
Enclosure immunity	Conducted RF fields	EN61000-4-6	A	130dBµV, 0.15-80MHz, 80% AM
	Radiated RF fields	EN61000-4-3	A	3V/m, 80-1000MHz, 80% AM
		ENV 50140	A	
	ESD	EN61000-4-2	B	±4kV contact, ±8kV air

CAR0724FP series rectifier

Input: 100-120/200-240V_{AC}; Output: 24V_{DC} @ 750W; 5V_{DC} @ 0.5A

Status and Control

All signals and outputs are referenced to Output return.

Status signals

These signals appear on the signal pins of the power supply connector.

AC_OK: A TTL compatible status signal representing whether the input voltage is within the anticipated range. This signal is pulled HI internally through a 10kΩ resistor to 5V_{SB}. The signal shall not assert for a minimum of 10ms after loss of AC power

DC_OK: A TTL compatible status signal representing whether the output voltage is present. This signal is pulled HI internally through a 4.7kΩ resistor to 5V_{SB}.

TEMP_OK: A TTL compatible status signal representing whether an over temperature exists. This signal is pulled HI internally through a 4.7kΩ resistor to 5V_{SB}.

If an over temperature should occur, this signal would pull LO for approximately 10 seconds prior to shutting down the power supply. The unit would restart if internal temperatures recover within normal operational levels. At that time the signal reverts back to its (HI) state.

Fault: A TTL compatible signal representing whether a fault exists. This is an open collector signal that needs to be pulled HI externally from the power supply. The maximum pull-up voltage level is 5Vdc. Open collector (HI) on this signal indicates that no Fault is present.

Write protect: This signal protects the contents of the EEPROM from accidental over writing. When left open the EEPROM is write protected. A LO (TTL compatible) permits writing to the EEPROM. This signal is pulled HI internally by the power supply. Used only for factory programming

Interrupt: A TTL compatible status signal, representing that the status settings of the power supply have changed. This signal needs to be pulled HI externally through a resistor. Maximum sink current ≤ 4mA and the pull up resistor should be tied to 5Vdc. Open collector (HI) on this signal indicates a no interrupt, i.e., normal, state.

I Monitor: This is an analog output signal that is proportional to the output current being delivered by the power supply. The scale for this signal is 0.1V/A ± 300mV

Control signals

Remote ON/OFF: A TTL compatible open collector signal that controls the main 24V output. A HI or open enables the unit ON. A short to ground or Logic LO will turn OFF the main 24V output.

Serial Bus Communications

Control signals

Address lines (A2, A1, A0): These signal pins allow up to eight (8) modules to be addressed on a single I²C bus. The pins are pulled HI internal to the power supply. For a logic LO these pins should be connected to 'Output Return'

Device	Address	Address Bit Assignments (Most to Least Significant)							
I/O Expander	0 x 4x	0	1	0	0	A2	A1	A0	R/W
EEPROM	0 x Ax	1	0	1	0	A2	A1	A0	R/W

Serial Clock (SCL): The clock pulses on this line are generated by the host that initiates communications across the I²C Serial bus. This signal is internally pulled-up to 3.3V.

Serial Data (SDA): This line is a bi-directional data line. This signal is internally pulled-up to 3.3V.

Digital Feature Descriptions

Master/Slave: The 'host controller' is always the MASTER. Power supplies are always SLAVES. SLAVES cannot initiate communications or toggle the Clock. SLAVES also must respond expeditiously at the command of the MASTER as required by the clock pulses generated by the MASTER.

Communications speed: Both 100kHz and 400kHz clock rates are supported. The power supplies default to the 100kHz clock rate. The minimum clock speed specified by SMBus is 10 kHz.

I/O Expander option (PCF8574ATD-T)

This power supply has a single status/control byte I/O expander. This byte takes the form;

7	6	5	4	3	2	1	0
n/s	n/s	Fault	ON/OFF	Temp_OK	n/s	DCOK	ACOK

n/s – not supported

Bits 0, 1, 3, and 5 are 'read_only' and are HI [1] during normal operation. The rectifier needs to be biased externally in order to 'read' its operational state without the presence of input power.

Bit 4 is a 'read/write' bit that can be used to verify the ON/OFF commanded state or change the commanded output of the rectifier. In order to turn the output OFF this bit needs to be pulled LO [0].

In order to turn OFF the main output the data byte should take the form 0 x EF, although the 'read only' bits will not change states.

To turn ON the main output the data byte should take the form 0 x FF, although the 'read only' bits will not change states. Note that the power supply output will not turn ON if the power supply is in an alarm state.

External EEPROM

A separate EEPROM, provides FRU_ID. This is a standard i2c compliant generic EEPROM with a single byte for its memory location. Standard i2c command structure applies.

The following FRU_ID information is stored in this EEPROM

Start Location	Length	Value	Description
00	7		Serial number, ascii
07	1	20	space
08	4		Date code [YYWW] ascii
0C	1	20	space
0D	17		Product code in ascii
1E	1	20	space
1F	1		Revision

CAR0724FP series rectifier

Input: 100-120/200-240V_{AC}; Output: 24V_{DC} @ 750W; 5V_{DC} @ 0.5A

LEDs

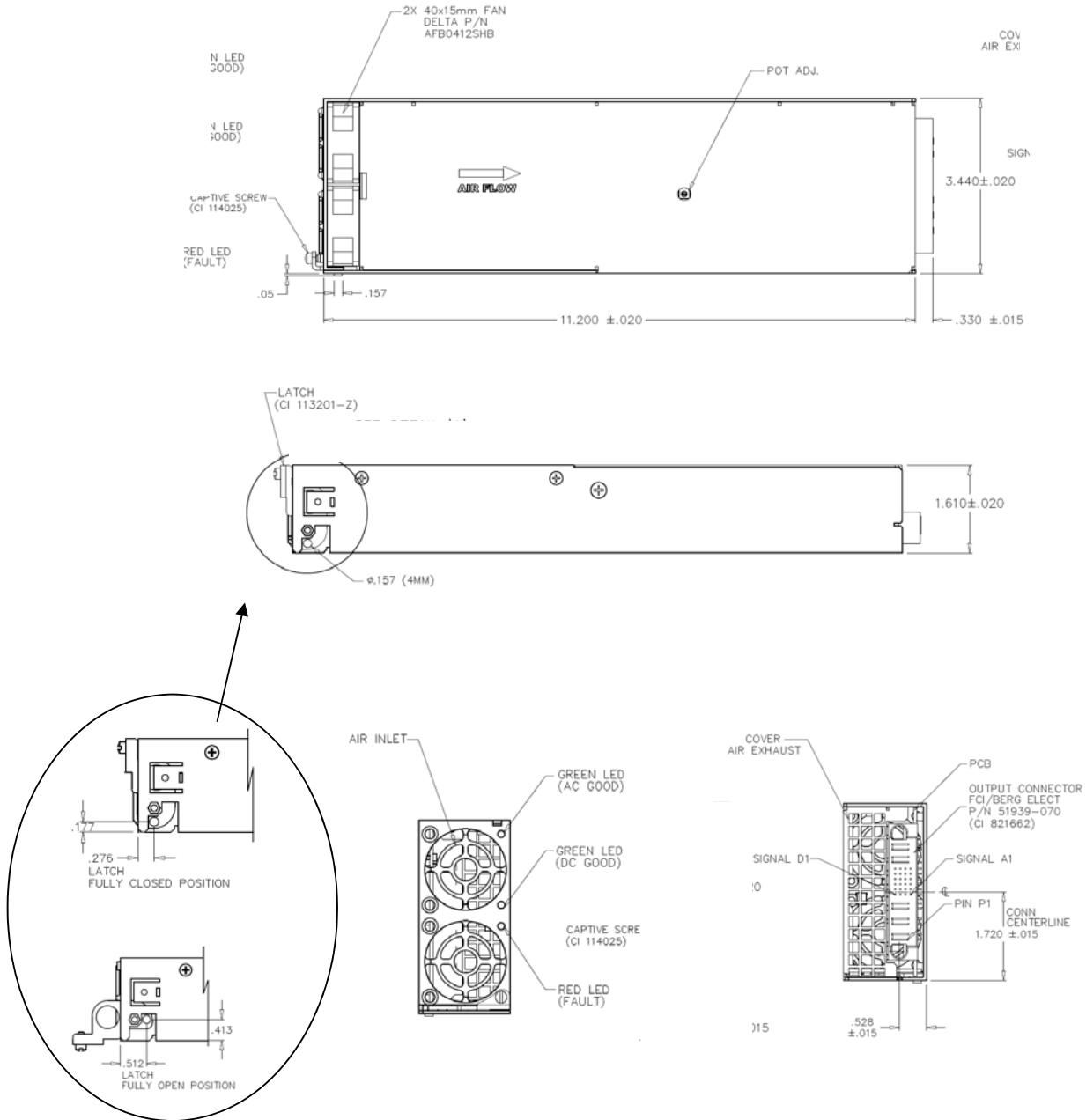
Three LEDs are located on the front faceplate.

The AC GOOD LED provides visual indication of the INPUT signal function. When the LED is ON Green the power supply input is within normal design limits.

The DC GOOD LED indicates if the main output of the power supply is ON. When this LED is Green the main output is ON.

The FAULT LED provides an indication that something is wrong with power delivery. When this LED is Red then something is wrong with power delivery.

Outline Drawing

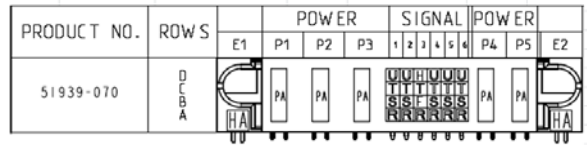


CAR0724FP series rectifier

Input: 100-120/200-240V_{AC}; Output: 24V_{DC} @ 750W; 5V_{DC} @ 0.5A

Connector and Pin Assignments

Output Connector: FCI Berg P/N: 51939-070
 Mating connector: FCI Berg P/N: 51915-050



Pin	Function	Pin	Function	Pin	Function
A1	V _{SB} [5V]	C1	I _{SHARE}	P1	Line
A2	V _{SB} [5V] Return	C2	n/c	P2	Neutral
A3	Signal Return	C3	Temperature OK	P3	Chassis
A4	Write Protect	C4	I ² C address A0	P4	V _{OUT+}
A5	Remote sense (+)	C5	I ² C address A1	P5	Output Return
A6	Remote sense (-)	C6	I ² C address A2		
B1	Fault	D1	V _{PROG}		
B2	I Monitor	D2	OVP Test Point		
B3	Module Enable	D3	Remote ON/OFF		
B4	PS_PRESENT_L	D4	DC OK		
B5	SDA	D5	AC OK		
B5	SCL	D6	Interrupt		

Note: Signal pin B3 is shorter last-to-make, first-to-break for hot plug

CAR0724FP series rectifier

Input: 100-120/200-240V_{AC}; Output: 24V_{DC} @ 750W; 5V_{DC} @ 0.5A

Ordering Information

Please contact your GE Sales Representative for pricing, availability and optional features.

PRODUCT	DESCRIPTION	PART NUMBER
750W Rectifier	+24V _{OUT} @ 31.25A, 5V _{STDBY} , RoHS 6 of 6, airflow front-to-rear	CAR0724FPXXXZ01A

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